E[redacted]0879642 1US

UNITED STATES PATENT APPLICATION

OF

NEIL MASON

FOR

AN ARRANGEMENT FOR CLAMPING A SAW BLADE

FILED

DECEMBER 15, 1999

DOCKET NO. CS1061#SP

AN ARRANGEMENT FOR CLAMPING A SAW BLADE

BACKGROUND OF THE INVENTION

The present invention relates to an arrangement for clamping a saw blade and to a saw blade for use with the clamping arrangement and has particular, although not exclusive, relevance to such a clamping arrangement as used on a power jigsaw, or the like.

The ability to clamp the blade of a power saw has long been known to be a desirable feature. Power saws which cut using a linear reciprocal action usually operate at high stroke speeds, such as 3,000 strokes per minute.

Because of the large forces generated by the cutting action at these reciprocal frequencies, there is a need to rigidly clamp the blade to the shaft on which it is mounted and which is being driven by the motor of the power saw. Failure to clamp the blade could result in the blade working loose from its mounting and warping or snapping during use.

However, the desire to rigidly clamp the saw blade to its driving shaft tends to create problems with the need to change saw blades depending upon the nature of the workpiece being sawed. For example, a different type of saw blade is used to saw wood as opposed to metal. Thus the need to constantly change the saw blade is not helped by the need to rigidly mount the blade on its driving shaft.

It would therefore be desirable to utilise a mechanism which on the one hand allows rigid clamping of the saw blade to its driving shaft, and on the other hand allows rapid interchanging of different types of saw blade.

SUMMARY OF THE INVENTION

It is thus an object of the present invention to provide an arrangement for clamping a saw blade to a reciprocable shaft, the shaft including a retaining member on which a blade for clamping may be mounted; the retaining member being lockable in at least two positions, each of the at least two positions clamping the blade at a predetermined angle relative to the shaft. The provision of a lockable retaining member allows rapid interchange of different types of saw blade and also allows rigid clamping of the saw blade to the shaft.

Preferably the arrangement includes restraining means for restraining movement of the blade, in a direction perpendicular to the line of reciprocation of the shaft, when

the blade is clamped. The restraining means aids with stability during use of the clamped blade.

Additionally or alternatively the restraining member may comprise a pin normally biased into a first position and which pin is moveable into a second position. Provision of a moveable pin allows for easy manual interchange of saw blades.

Advantageously the pin may carry a lug having a predetermined shape, which lug is arranged to co-operate with a correspondingly shaped recess. By arranging for the lug to have a shape which fits in a co-operable recess on the blade, a stable and rigid clamping of the blade may be achieved.

Preferably the pin may rotate about an axis such that when the lug is rotationally aligned with the recess, the biasing action causes the lug to fit within the recess thereby preventing further rotation of the pin about the axis. Additionally, when the lug is in the recess, the retaining member may be locked. Also the blade for clamping may be mounted on the lug.

In a preferred embodiment, the restraining means may comprise a plurality of arms depending from the shaft. Advantageously the plurality of arms may be arranged in pairs and a blade for clamping is positioned between a pair of the arms when clamped.

It is a further object of the present invention to provide a saw blade for use with the clamping arrangement defined above, the saw blade comprising a main body portion; a shank extending from the main body portion; and a mounting hole formed in the shank to enable operative coupling of the saw blade to the mounting arrangement, the saw blade characterised in that the mounting hole extends in two dimensions, the length of the extent in one dimension being greater than the length of the extent in the other dimension, and wherein the one dimension extends generally perpendicularly with respect to the other dimension. This arrangement allows for rigid clamping of the blade in use, or when attached to its mount.

Preferably the shank is integral with the body portion. This allows for reduced use of materials during manufacture and hence permits cost saving.

Additionally or alternatively the mounting hole is formed within the body of the saw blade and does not touch any peripheral surface of the saw blade. This permits a strong saw blade to be formed.

Advantageously the shape of the mounting hole may be rectangular, oval or elliptical. Also the length of extent may be greater for the dimension parallel with the line of action of the saw blade in use than for the dimension perpendicular with the direction of the line of action of the saw blade in use.

According to yet a further aspect of the present invention there is provided, in combination, a clamping arrangement and a saw blade as defined in the appendant claims.

B

BRIEF DESCRIPTION OF THE DRAWINGS

The present invention will now be described, by way of example only, and with reference to the accompanying drawings, of which:-

Figure 1 shows a reciprocable shaft on which a saw blade may be mounted in accordance with an embodiment of the present invention;

Figure 2 shows the shaft of Figure 1, but with a saw blade mounted thereon in an operating position from one side;

Figure 3 shows the view of Figure 2, but from the other side of the saw blade;

Figure 4 shows a side view of the reciprocable shaft of Figure 1, but with the retaining member thereof being in an unlocked position;

Figure 5 shows the shaft of Figure 1 with the saw blade mounted thereon in a locked position;

Figure 6 shows a sectional view along the line A-A of Figure 5;

Figure 7 shows a sectional view along the line B-B of Figure 5;

Figure 8 shows a side view of a saw blade and the reciprocable shaft of Figures 2 and 3 in an unlocked position;

Figure 9 shows the view of Figure 8, but with the saw blade now retained in its stored and locked position;

Figure 10 shows a schematic illustration of the motor and internal mechanisms of a power tool in accordance with an embodiment of the present invention;

Figure 11 shows a schematic side representation of Figure 10;

Figure 12 shows a side view of a powered saw in accordance with an embodiment of the present invention; and

Figure 13 shows a side view of an alternative use of a powered saw to that of Figure 12.

Figure 14 illustrates schematically various hole configurations for a saw blade in accordance with an aspect of the present invention.

Referring firstly to Figure 1, there is shown a shaft (2) formed from pressed metal, such as steel, and having in the centre thereof a yoke (4). One end of the shaft (2) is formed integrally with a depending retaining member, here a blade mount (6). The blade mount (6) comprises a restraining means, here two arms (8) which depend from the shaft (2). The blade mount further includes a pin (10) which will be described in more detail below.

Referring now also to Figures 2 and 3, it can be seen that the shaft (2) is arranged to drive a saw blade (12) presented thereto and which is mounted on the blade mount (6). It can be seen that the saw blade (12) has a shank (14) which has formed therein a hole (16) (seen more clearly in Figures 5, 8 and 9) for mounting the blade (12) on a lug (18) of the pin (10). Although the saw blade (12) includes a shank in this, preferred, embodiment, the shank may be formed integrally with the body portion, as discussed below and with reference to Figure 14(b).

Referring now to Figure 4, it can be seen that the pin (10) comprises a head (20) formed on one side of the blade mount (6) and a lug (18) co-operating with the head (20) formed on the other side of the blade mount (6). The shape of the lug (18) is the same as that of the hole (16) formed in the blade (12). This allows for the blade (12) to be mounted snugly on the lug (18).

The pin (10) is rotatable about its axis shown as X-X in Figure 4 and it can be seen from this figure that the blade mount (6) has a recess (21) formed therein such that the lug (18) may sit within the recess (21) when it is in one of two positions. Because the pin (10) is rotatable about the axis X-X, then whenever the lug (18) is aligned with the recess (21) (in either of two positions 180° apart) then it will fit within the recess (21). In any other position, the lug (18) cannot sit within the recess (21).

In order for the lug (18) to be selectively aligned or not with the recess (21), the head (20) of the pin (10) is spring biased. In this manner, therefore, whenever the lug (18) is aligned with the recess (21) it "pops" into the recess and is held therein until the user exerts sufficient force against the head (20) against the action of the spring

(described later below) to force the lug (18) out of the recess (21) and therefore allow the pin (10) to be rotated about the axis X-X.

Referring now additionally to Figure 5, it can be seen that the saw blade (12) is held in its locked position (because the lug (18) is within the recess (21)) against the shaft (2). Because the shaft (2) is arranged to reciprocate, that is drive the blade (12) backwards and forwards along a linear path, then it will be understood that each of the arms (8) is arranged to flank the shank (14) of the blade (12) to prevent the blade (12) from becoming detached from the blade mount (6). This is because the arms (8) prevent any movement of the blade (12) in a direction perpendicular to the direction of reciprocation of the shaft (2).

In order to understand the operation of the pin (10) and its interaction with the blade (12), reference will now be made in particular to Figures 5, 6 and 7.

The pin (10) is spring biased, and in the case of Figure 6, it can be seen that the head (20) of the pin (10) has not been depressed and therefore under the action of the spring (22), the head (20) is forced to the left of Figure 6 therefore allowing the lug (18) to sit within the recess (21). This does, of course, presuppose that the lug (18) is aligned with the recess (21) as has been described here above. Assuming this to be the case, then the blade will be locked in this position. Rotation of the pin and therefore the lug (18) are not possible because the lug (18) is located within the housing (20).

Referring now to Figure 7, it will be described how the lug (18) is released from the recess (21) in order to allow rotation of the saw blade (12).

In Figure 7 the user has pushed the head (20) to the right of the figure and therefore caused compression of the spring (22). The movement of the pin (10) to the right of the figure releases the lug (18) from the recess (21) and therefore allows rotation of the pin (10) about its axis X-X. Because the lug (18) is now no longer located within the recess (21) then rotation of the pin (10) means that the blade (12) may be rotated as well. Referring also to Figure 8, this shows how the saw blade (12) has been rotated through 90° as compared with the locked position of Figure 5.

Whilst referring to Figure 8, it can be seen that, because the blade (12) is now perpendicular to the shaft (2) rather than parallel therewith as was the case in Figure 5, then the shank (14) of the saw blade (12) is no longer constrained by the arms (8)

of the blade mount (6). This means that the entire blade (12) may be removed from the lug (18) and could, for example, be replaced by an alternative saw blade.

Referring now to Figure 9, it can be seen that further rotation of the pin (10) and the blade (12) is possible (because there is no alignment between the lug (18) and the recess (20)). The saw blade (12) as shown in Figure 9 has now been rotated through 180° with respect to that of Figure 5. It will be appreciated that the lug (18) is now re-aligned with the recess (21) and therefore if the user ceases to apply any force to the head (20) of the pin (10), then the lug (18) may fall back into the recess (21) and therefore lock the saw blade (12) in the position shown. This may be useful when the saw is to be carried around but the blade needs to be kept safely within the body of the saw, for example, to avoid damage to the saw blade.

Although only shown in dotted outline in Figure 9, it will understood that a further pair of arms (8) may be employed in the blade mount (6) to retain the saw blade (12) in the position shown.

Referring now to Figures 14(a), (b) and (c), it can be seen that the mounting hole (16) extends in two, generally perpendicular directions. In the figures, these directions have been indicated by the axes marked "x" and "y". It can be seen that the length of extent of one of these axes, here "x", is greater than the length of extent of the other of these axes, here "y". This is permit rigid (that is non-moveable) mounting of the blade (12) on the lug (18).

It can be seen from these figures that it is preferable for the mounting hole (16) to be formed within the body of the saw blade (12) such that the hole (16) does not touch any peripheral surface of the blade (12).

Figure 14(a) illustrates the case where the hole (16) is formed as a rectangle; Figure 14(b) that where the hole (16) is formed as an ellipse; and Figure 14(c) that where the hole (16) is formed as an oval. These variants all share the common property of having a length (x) of extent in one dimension greater than that in another, orthogonal direction (y).

Referring now to Figures 10 and 11 particularly, the internal mechanism of the power tool embodying the present invention will be described. In these examples, the power tool is a power saw.

An electric motor (24) is operable in conventional manner to drive a motor spindle (26) coupled to a drive wheel (28). The teeth of the drive wheel (28) mesh with the teeth of a gear wheel (30) having formed thereon an eccentric (32). Although not shown in the drawings, the eccentric (32) must be counter-balanced and those skilled in the art will appreciate this fact.

The eccentric (32) fits into the yoke (4). In this way, when the motor (24) is activated, it drives the drive wheel (28) which in turn causes rotation of the gear wheel (30). The circular movement of the eccentric (32) sitting in the yoke (4) therefore causes a linear reciprocal motion of the shaft (2) in a right-left-right motion as the drawings are viewed. In order to ensure that the only motion of the shaft (2) at the operative end (that is where the blade (12) and the blade mount (6) are situated) occurs, a retaining bar (34) having linear bearings surrounds the shaft (2). This restrains movement of the shaft only in the left-right-left linear direction.

Whilst in the above examples of Figures 10 and 11 only one drive wheel (28) is shown, those skilled in the art will appreciate that any desired gearing arrangement may be used. The choice of gearing arrangement will depend primarily on the step up/step down requirement between the rotational output speed of the motor (24) and the frequency of linear reciprocation needed for the shaft (2).

Referring now particularly to Figures 12 and 13, two further embodiments of the present invention are now described. It can be seen by comparing these two figures, that the power tools shown therein share the same body (36). However, the tools shown in Figures 12 and 13 each are used for a different purpose and operate in different modes, as will be described here below. It should be understood that, for the purposes of Figures 12 and 13, the internal mechanism as shown in Figures 10 and 11 is incorporated therein. However, because Figures 12 and 13 show the tool from the outside, then the internal mechanisms cannot be seen.

In Figure 12, the tool is used as a so-called panel saw. Panel saws are generally used for sawing large pieces of wood and the like in the form of blocks such as logs. In the present invention, it has been found desirable to be able to offer the user the facility of using the panel saw not only in its powered mode but also manually. That is, the user should be able to grip the handle (38) of the panel saw and use it as a conventional manually operated saw whether the blade is being driven by the motor

(24) or not. To achieve this the saw needs to be lightweight but also it has been found that, when the saw is being driven by the motor (24), conventional reciprocating action will prevent manually using the tool with ease, because of the combination of the frequency of reciprocation of the saw blade (12) and the length of each reciprocal stroke.

Conventionally, it has been found that the frequency of reciprocation of the blade (12) has been around 3,000 strokes per minute. Additionally, the length of each reciprocal stroke has been in the region of 20mm. The combination of this particular frequency and stroke length results in large vibrational forces being felt by the user. Additionally, this creates large interial forces which also need to be overcome in order to be able to use the saw manually. With a conventional panel saw, therefore, if the user wishes to use it manually rather than in its conventional powered mode, a degree of discomfort would be felt because the saw would be vibrating at a frequency which does not lend itself to holding the saw comfortably. Additionally, the amplitude of each reciprocal stroke of the blade (12) is so large that high inertial forces are felt by the user mean that to be able to pull and push the saw in a manual mode is not easily achievable.

It has been found that by reducing the length of each reciprocal stroke to preferably around 10mm and concomitantly increasing the reciprocal stroke frequency to preferably around 6,500 strokes per minute, that this combination of lower stroke length and higher frequency results in less adverse vibrational and inertial forces being felt by the user. This then enables the panel saw of Figure 12 to be used as a manual saw simply by holding the handle (38). Additionally, if the user requires a further grip on the body (36), a recess, formed as insert (40) is available for gripping by the other hand of the user (that is the hand which does not grip the handle (38)).

Although in the example described with reference to Figure 12 the preferred frequency of oscillation has been given as 6,500 strokes per minute, the present invention has been found to operate effectively with a frequency of vibration between 3,000 and 10,000 strokes per minute. Similarly, although the preferred amplitude of each reciprocal stroke is given as 10mm, it has been found that the present invention works effectively with a range of 5 to 15mm.

Referring now also to Figure 13, it can been seen that the same body (36) is used with a different saw blade (12'). Indeed, the saw blade (12') is that found on conventional "jigsaws". Jigsaws are tools which are used with relatively small saw blades and are used for cutting accurate shapes in a workpiece. Conventionally, jigsaws are held relative to the workpiece in a different attitude to panel saws. This can be seen by reference to the difference in attitude between Figure 12 and 13. In Figure 13, the body (36) can be seen resting on a block (42) which represents a workpiece. In use of the jigsaw, the body (36) would be held on the block (42) in the attitude shown in Figure 13.

It can be seen from Figure 13 that the handle (38) is now positioned relative to the workpiece (42) such that the body (36) may easily be used as a jigsaw. In use of the jigsaw, a user exerts a force via the handle (38) in the direction of the large arrow marked "A". This is so that the blade (12') is driven also in the direction of the arrow "A" to cut through the workpiece.

It can be seen by comparing Figures 12 and 13, that the handle (38), although itself the same in both figures, it able to be used for exerting forces in a different direction depending on which mode of use (either the panel saw of Figure 12 or the jigsaw of Figure 13) the tools are put to.

The handle (38) is positioned adjacent a trigger (44) which trigger (44) is operable by user when the handle (38) is gripped.

It can be seen from both Figures 12 and 13, therefore, that the position of the handle (38) relative to the body (36) is such that the user may operate the saw in a plurality of positions relative to a workpiece. Thus, regardless of whether the tool is being used as a panel saw in Figure 12 or a jigsaw in Figure 13, the same handle is used for operating the saw. It will be appreciated by those skilled in the art, that this holds true whether the panel saw of Figure 12 is being used as a powered saw by powering the motor (24) via an electricity supply cable (46), or whether it is being used manually.

In the examples shown, the trigger (44) is formed integrally with the handle (38). This need not necessarily be the case, and the trigger may be formed separately or indeed on another part of the body (36).

From Figures 12 and 13, therefore, it can be seen that the handle (38) is accessible from one of two sides, depending on whether the tool is to be used as a panel saw or a jigsaw. It is envisaged that the present invention is of scope to allow more than two sides of the handle (38) to be used depending on the purpose to which the tool is being put.

It can be seen from Figures 12 and 13, that the body (36) also includes a pivotable sole plate (48). The sole plate (48) is pivotable about pivot point (50). The pivot point (50) includes a means (not shown) for allowing the sole plate (48) to be held at any one of a desired position around the range of possible pivotable positions about the point (50). In the example of Figure 12, the sole plate (48) is tucked underneath the body (36). In the example of Figure 13, the sole plate (48) is pivoted through 270° so as to act as the guide sole plate for a conventional jigsaw. In this mode, the blade (12) passes through the sole plate (48) when used in its jigsaw mode.

Those skilled in the art will appreciate that, conventionally, jigsaws use a sole plate (48) to act as a guide when cutting a workpiece. In the example of Figure 13, although it cannot be seen from the drawing, the sole plate (48) includes visual indicia to allow the user to see exactly where the blade (12) will cut the workpiece when viewed from above the body (36).

It can be seen by comparing Figures 12 and 13, therefore, that the body (36) defines two working surfaces (52 and 54) dependent upon which mode the tool is being used. In the examples above, working surface (52) is used for the jigsaw mode of Figure 13 and working surface (54) is used for the panel saw mode of Figure 12.

It will be understood by those skilled in the art that the sole plate (48) may be positioned at any suitable angle relevant to the body (36) dependent upon the use to which the tool is being put.

By referring now particularly to Figure 13 it can be seen that, when the tool is used as a jigsaw, a user may also grip the dimpled surface (56) in order to assist with guiding the tool during use. Alternatively, this surface (56) can be used to form cooling vents within the body of the saw.